

MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

Paper 1 Multiple Choice

October/November 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Data Sheet is printed on page 15.

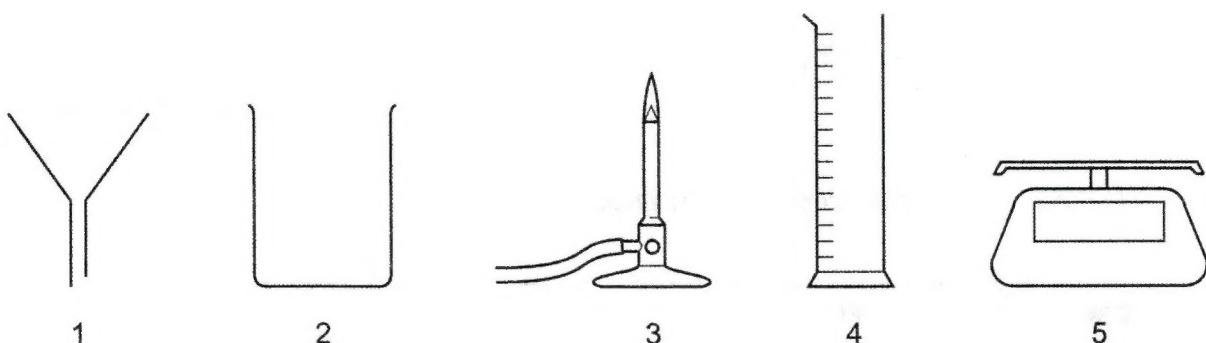
A copy of the Periodic Table is printed on page 16.

The use of an approved scientific calculator is expected, where appropriate.

21 Barium sulfate is insoluble in water.

Barium sulfate is made by adding 20 cm³ of aqueous barium nitrate to dilute sulfuric acid.

Which pieces of apparatus are needed to obtain solid barium sulfate from aqueous barium nitrate and dilute sulfuric acid?



- A** 1, 2 and 4 **B** 1, 4 and 5 **C** 2, 3 and 4 **D** 2, 4 and 5

22 A label is missing from a bottle of a yellow solution Q.

In order to identify the solution two simple chemical tests are carried out.

test 1 A few drops of aqueous sodium hydroxide are added to a sample of Q. A red-brown precipitate is formed.

test 2 Aqueous sodium hydroxide and aluminium are added to another sample of Q and warmed. A pungent gas, which turns damp red litmus paper blue, is produced.

What is Q?

- A** iron(II) nitrate
B iron(III) nitrate
C iron(II) sulfate
D iron(III) sulfate

23 Two isotopes of chlorine are $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$.

Which statement about these isotopes is correct?

- A** They have the same number of electrons and protons.
B They have the same number of neutrons and electrons.
C They have the same number of neutrons and protons.
D They have the same number of nucleons and electrons.

- 24** Element X has the electronic configuration 2,4.

Element Y has the electronic configuration 2,6.

What is the formula of the compound formed between X and Y?

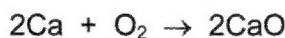
A XY₂

B X₂Y

C X₂Y₃

D X₃Y₂

- 25** 2.0 g of calcium are completely burnt in pure oxygen.



Which volume of oxygen is used in this reaction at room temperature and pressure?

A 0.025 dm³

B 0.050 dm³

C 0.60 dm³

D 1.2 dm³

- 26** Which ions are present in the compound Fe₂(SO₄)₃?

A Fe²⁺ and SO₄²⁻

B Fe²⁺ and SO₄³⁻

C Fe³⁺ and SO₄²⁻

D Fe³⁺ and SO₄³⁻

- 27** Solutions of two chemicals are mixed in a beaker.

A reaction occurs and a fall in temperature is observed.

Which statement is correct?

A An endothermic reaction occurs and the reacting chemicals gain energy.

B An endothermic reaction occurs and the reacting chemicals lose energy.

C An exothermic reaction occurs and the reacting chemicals gain energy.

D An exothermic reaction occurs and the reacting chemicals lose energy.

- 28** Which change in conditions decreases the speed of the reaction between marble chips and dilute hydrochloric acid?

A decreasing the concentration of the acid

B decreasing the initial size of the marble chips

C increasing the temperature of the acid

D increasing the volume of the acid

29 Which statement describes oxidation?

- A Electrons are gained and the oxidation state decreases.
- B Electrons are gained and the oxidation state increases.
- C Electrons are lost and the oxidation state decreases.
- D Electrons are lost and the oxidation state increases.

30 Zinc oxide is an amphoteric oxide.

Which statement about zinc oxide is correct?

- A It will not react with hydrochloric acid but will react with sodium hydroxide.
- B It will not react with hydrochloric acid or sodium hydroxide.
- C It will react with hydrochloric acid and sodium hydroxide.
- D It will react with hydrochloric acid but not sodium hydroxide.

31 The table shows the solubility in water of some copper compounds.

| compound | solubility |
|----------------------|------------|
| copper(II) carbonate | ✗ |
| copper(II) chloride | ✓ |
| copper(II) hydroxide | ✗ |
| copper(II) oxide | ✗ |

Which method is used to prepare copper(II) chloride?

- A adding copper to dilute hydrochloric acid at room temperature
- B precipitating the salt by adding copper(II) sulfate solution to dilute hydrochloric acid
- C titrating copper(II) hydroxide with dilute hydrochloric acid
- D warming copper(II) oxide with dilute hydrochloric acid

32 Four elements have the following electronic configurations.

W 2,8,1

X 2,8,2

Y 2,8,5

Z 2,8,8

Which statement is correct?

- A** All four elements are in the same group in the Periodic Table.
- B** All four elements are in the same period in the Periodic Table.
- C** W is a metal but X, Y and Z are non-metals.
- D** X is a metal but W, Y and Z are non-metals.

33 Astatine is at the bottom of Group VII in the Periodic Table.

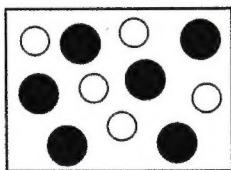
Which row describes the properties of astatine?

| | colour | state | reaction with aqueous potassium bromide |
|----------|--------|--------|---|
| A | black | liquid | bromine displaced |
| B | black | solid | no reaction |
| C | black | solid | bromine displaced |
| D | brown | liquid | no reaction |

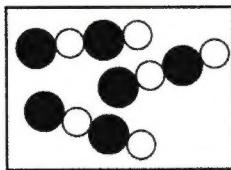
34 The diagrams represent different arrangements of atoms.

Which diagram represents an alloy?

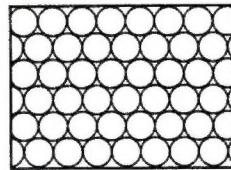
A



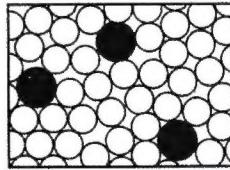
B



C



D



- 35 Three metals, X, Y and Z, were heated separately with the oxides of four metals, P, Q, R and S, to find the order of reactivity.

The results are shown in the table.

| metal | metal oxide | | | |
|-------|-------------|---|---|---|
| | P | Q | R | S |
| X | X | X | X | X |
| Y | ✓ | ✓ | X | ✓ |
| Z | X | ✓ | X | X |

key
✓ = reaction observed
X = no reaction observed

What is the order of the reactivity of the metals from the most reactive to the least reactive?

- A $X \rightarrow Z \rightarrow Y$
B $Y \rightarrow X \rightarrow Z$
C $Y \rightarrow Z \rightarrow X$
D $Z \rightarrow Y \rightarrow X$
- 36 What is the most abundant noble gas in the Earth's atmosphere?

- A argon
B helium
C krypton
D xenon

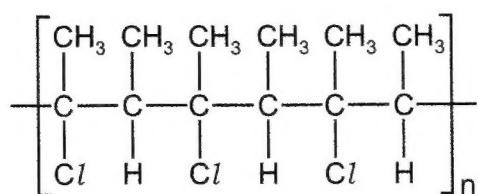
- 37 When petrol (gasoline) is burnt in a car engine, gases are produced.

- Which gas is toxic and is produced by incomplete combustion of petrol?
- A carbon dioxide
B carbon monoxide
C oxides of nitrogen
D water vapour

- 38 Which hydrocarbon is an alkane?

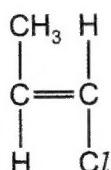
- A C_6H_6 B C_6H_{10} C C_7H_{14} D C_7H_{16}

39 The diagram shows part of the structure of an addition polymer.

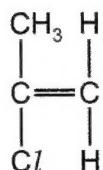


Which monomer is used to make this polymer?

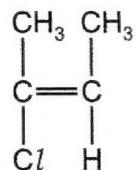
A



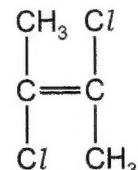
B



C



D



40 Which product is formed when ethanol is oxidised by acidified potassium manganate(VII)?

- A ethane
- B ethanoic acid
- C ethene
- D methanol

Multiple Choice Questions

21. (A)

Since barium sulfate is insoluble in water, it is best prepared by precipitation. 20 cm³ of aqueous barium nitrate is measured using a measuring cylinder and added to dilute sulfuric acid in a beaker to allow for the reaction to take place. The white precipitate formed is then filtered using a funnel.

EXAM TIP:

A measuring cylinder is needed to measure 20 cm³ of aqueous solution. A beaker is needed to hold the dilute sulfuric acid. A funnel is needed to separate the mixture and the insoluble solid (barium sulfate).

22. (B)

The observation in test 1 indicates the presence of Fe³⁺ ions while the observation in test 2 indicates the presence of NO₃⁻ ions. Therefore, Q is iron(III) nitrate.

EXAM TIP:

A reddish-brown precipitate formed in a reaction with aqueous sodium hydroxide indicates the presence of iron(III) ion (Fe³⁺). The pungent gas which turns damp red litmus paper blue is ammonia gas. When ammonia gas is produced upon addition of aqueous sodium hydroxide and aluminium, and the mixture is warmed, it indicates the presence of nitrate ion (NO₃⁻).

23. (A)

Since both isotopes of ³⁵Cl and ³⁷Cl are electrically neutral, they have the same number of electrons and protons.

EXAM TIP:

Isotopes are atoms of the same element that have the same number of protons but different numbers of neutrons.

24. (A)

The number of valence electrons of elements X and Y are 4 and 6 respectively. Thus, they are likely to form covalent bonds by sharing electrons.

Each element Y atom shares two electrons with an atom of element X to attain a noble gas electronic configuration. Hence, the formula of the compound formed between X and Y is XY₂.

EXAM TIP:

Elements form bonds to attain a noble gas electronic configuration.

25. (C)

$$\text{Number of moles of calcium} = \frac{20}{40}$$

$$= 0.05 \text{ mol}$$

Based on the chemical equation, 2 moles of Ca react with 1 mole of oxygen gas to form 2 moles of CaO.

$$\therefore \text{Number of moles of oxygen} = \frac{1}{2} \times 0.05$$

$$= 0.025 \text{ mol}$$

1 mole of any gas occupies 24 dm³ at room temperature and pressure.

$$\text{Volume of O}_2 \text{ used} = 0.025 \times 24$$

$$= 0.60 \text{ dm}^3$$

EXAM TIP:

1 mole of any gas occupies 24 dm³ at r.t.p.

26. (C)

Based on the given formula, the mole ratio of iron and sulfate ions in the compound is 2 : 3.

$$\text{Since each sulfate ion, SO}_4^{2-} \text{ has a charge of } 2-, \text{ total charge of the anions} = 2- \times 3$$

$$= 6-$$

Thus, the total charge of the cations is 6+.

$$\therefore \text{Charge of each iron ion} = \frac{6+}{2}$$

$$= 3+$$

EXAM TIP:

The total positive and negative charges of the ions in the compound must be balanced.

27. (A)

A fall in temperature observed in a chemical reaction indicates that heat is absorbed by the reacting chemicals. Thus, it is an endothermic reaction and the reacting chemicals gain energy overall.

EXAM TIP:

An endothermic reaction results in a fall in surrounding temperature.

28. (A)

A decrease in the concentration of dilute hydrochloric acid results in a lower number of reacting particles per unit volume in the reaction mixture, leading to a lower frequency of collisions between marble chips and dilute hydrochloric acid, subsequently resulting in a lower frequency of effective collisions. Therefore, the speed of the reaction decreases.

EXAM TIP:

The speed of reaction decreases when the concentration of reactant decreases; the size of the reactant increases or the temperature of the reactant decreases. The speed of reaction remains the same when the volume of the acid increases because the concentration of the acid remains the same.

29. (D)

An oxidation reaction is a process where there is a loss of electrons and an increase in oxidation state.

EXAM TIP:

An oxidation reaction is a process where there is a loss of electrons and an increase in oxidation state.

30. (C)

EXAM TIP:

An amphoteric oxide reacts with both acids and alkalis.

31. (D)

- (A): Copper is an unreactive metal, which does not react with hydrochloric acid.
(B): Copper(II) chloride is a soluble salt, hence cannot be prepared by precipitation method.
(C): Copper(II) hydroxide is insoluble in water, hence titration method cannot be used.
(D): By warming excess insoluble copper(II) oxide with dilute hydrochloric acid, followed by filtration, copper(II) chloride solution is obtained as filtrate.

EXAM TIP:

A base is required for the reaction with dilute hydrochloric acid to form the salt. Deduce the method used based on the solubility of the compounds in water.

32. (B)

All four elements have the same number of shells occupied with electrons. Thus they belong to the same period in the Periodic Table.

W, X, Y and Z are sodium, magnesium, phosphorus and argon respectively. Sodium and magnesium are metals that belong to Group I and II respectively. Phosphorus and argon are non-metals that belong to Group V and 0 respectively.

EXAM TIP:

Relate the electronic configurations of the elements to their relative positions in the Periodic Table.

33. (B)

Down Group VII, the boiling point of the elements increases and the colour of the elements becomes darker. Conversely, the reactivity of Group VII elements decreases down the group.

Since astatine is at the bottom of Group VII in the Periodic Table, it is likely to exist as a black solid and is less reactive than bromine, thus it is unable to displace bromine from potassium bromide.

34. (D)

In an alloy, the atoms are closed together as it is a solid. Furthermore, atoms of different sizes disrupt the orderly arrangement of the atoms.

35. (C)

A more reactive metal displaces a less reactive metal from its compound. Thus, metal Y is the most reactive as it is able to react with the oxides of P, Q and S. Metal Z is less reactive than metal Y as it only reacts with the oxide of Q. Metal X is the least reactive as it does not react with any of the oxides.

EXAM TIP:

Compare the reactivity of the metals based on the number of metal oxides they react with.

36. (A)

Argon is the most abundant (around 1%) noble gas in the Earth's atmosphere.

EXAM TIP:

Dry air consists of approximately 78% nitrogen, 21% oxygen, 0.97% noble gases (mainly argon) and 0.03% carbon dioxide.

37. (B)

Incomplete combustion of petrol produces carbon monoxide which binds to haemoglobin in red blood cells and causes oxygen deprivation that leads to difficulty in breathing or death.

EXAM TIP:

Carbon monoxide is toxic and is produced by incomplete combustion of petrol.

38. (D)

An alkane has the general formula of C_nH_{2n+2} .

When $n = 7$,

number of carbon atoms = 7

$$\begin{aligned} \text{number of hydrogen atoms} &= 2(7) + 2 \\ &= 16 \end{aligned}$$

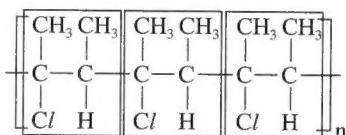
$\therefore C_7H_{16}$ is an alkane.

EXAM TIP:

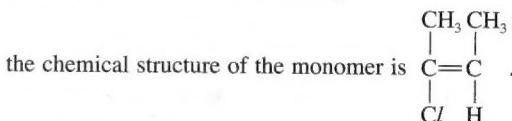
The general formula of alkanes is C_nH_{2n+2} .

39. (C)

The repeat unit of the addition polymer is as shown.



Since the addition polymer is formed from a monomer that has the structure of an alkene,



EXAM TIP:

Identify the repeat unit from the structural formula given.

40. (B)

Oxidation of ethanol results in a gain of an oxygen atom to form ethanoic acid.

EXAM TIP:

When heated with oxidising agents such as acidified potassium manganate(VII), alcohols undergo oxidation to form carboxylic acids.